SmarterComputing

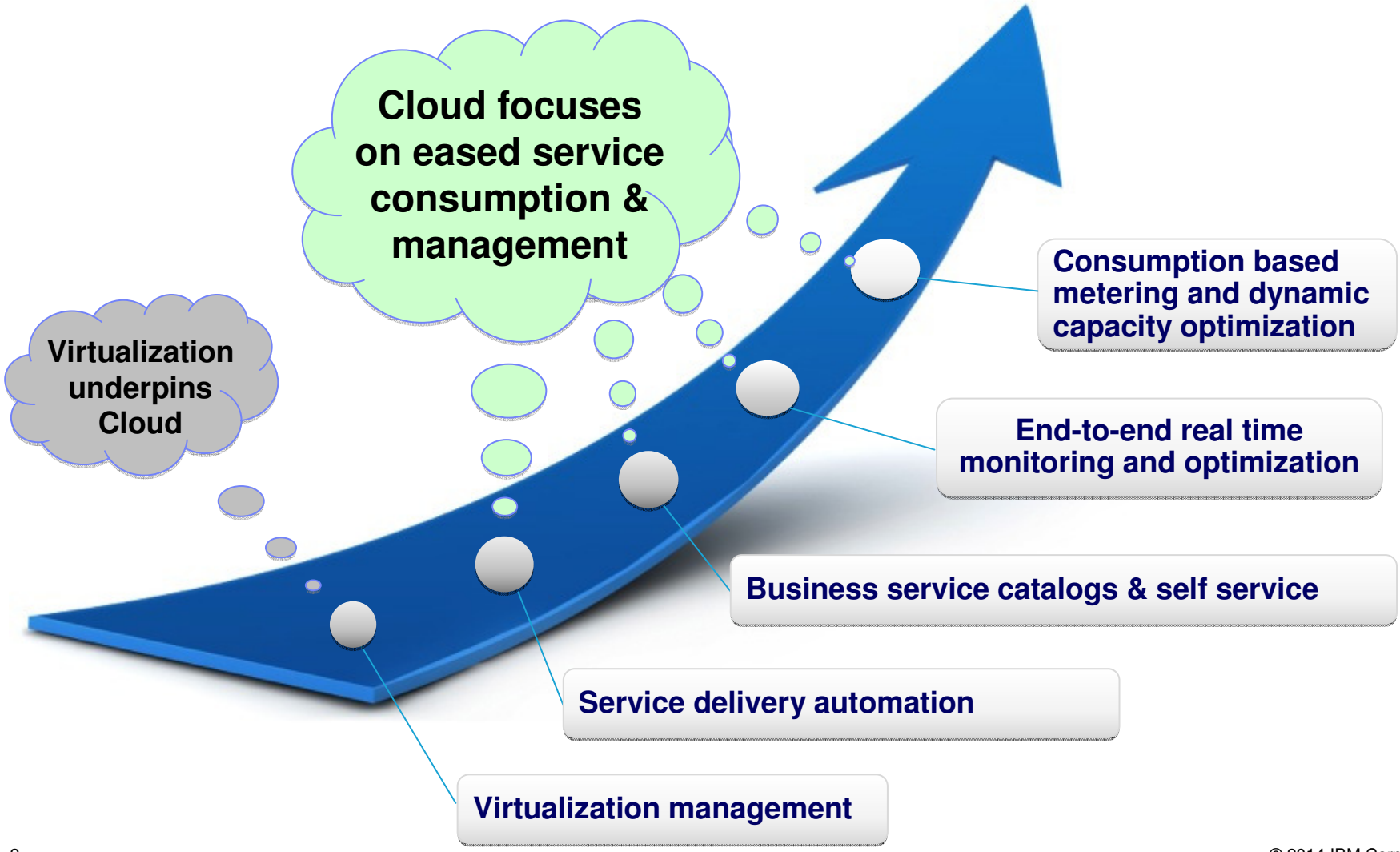
Establishing Cloud Environments on zEnterprise

Strategic Direction

August 4, 2014

Kershaw Mehta
kershaw@us.ibm.com

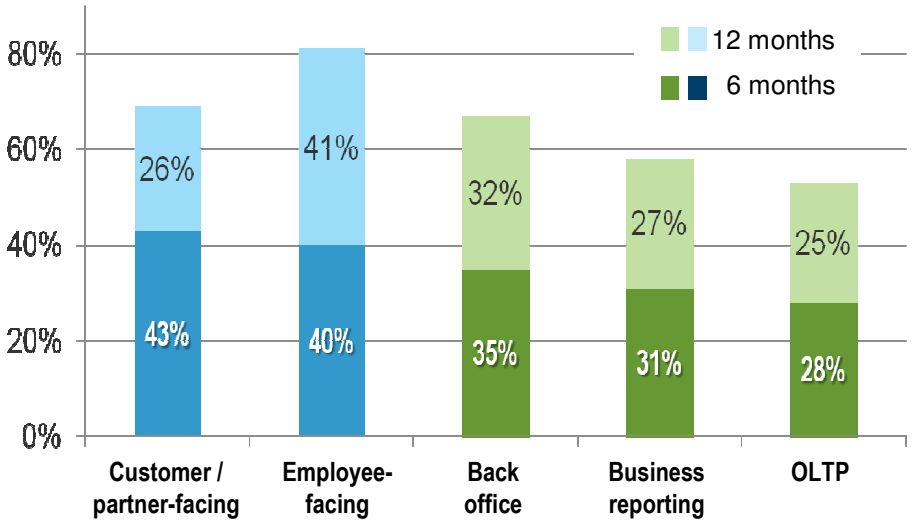
Organizations are now moving beyond virtualization to higher value stages of Cloud Computing



3 of 5 top cloud scenarios are traditional enterprise workloads

What types of applications do you plan to host on cloud platforms?

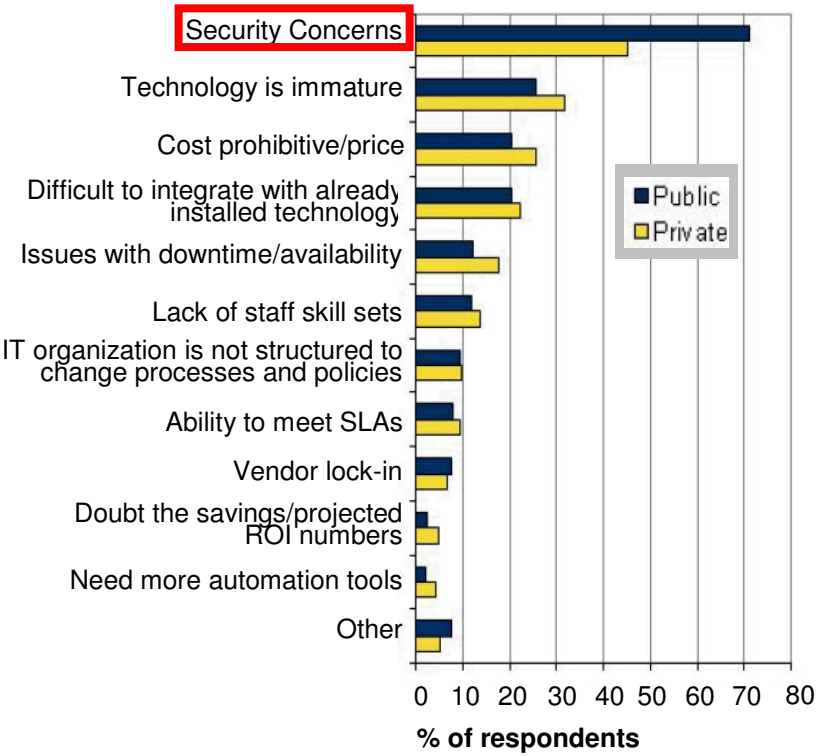
(Base: 200 North American and European hardware and infrastructure decision-makers)



Source: A commissioned study conducted by Forrester Consulting on behalf of IBM, October, 2012

Top Challenges in Moving to a Public or Private Cloud

Q: What do you see as the top 2 challenges in moving to a public/private cloud?



Source: IDC's "Data Center and Cloud Computing Survey", January 2010

zEnterprise Differentiation for Deploying Clouds on System z

90%+ utilization
Increased Productivity

- Advanced workload management that provisions resources on the fly for 90%+ utilization and maximizes ROI
- Significant software license savings due to zEnterprise power/scale
- 79% less TCO vs. leading public cloud alternatives

100,000 virtual servers
Higher Utilization

- Maintain service levels with up to 100% CPU utilization
- “Shared everything” architecture
- Manage up to 100,000 diverse virtual servers
- Unmatched scalability with 24X more scale than x86

80% less energy
More Efficient Data Center

- Up to 80% less energy than existing distributed servers
- Less floor space
- Fewer parts to manage

Greater Reliability, Availability

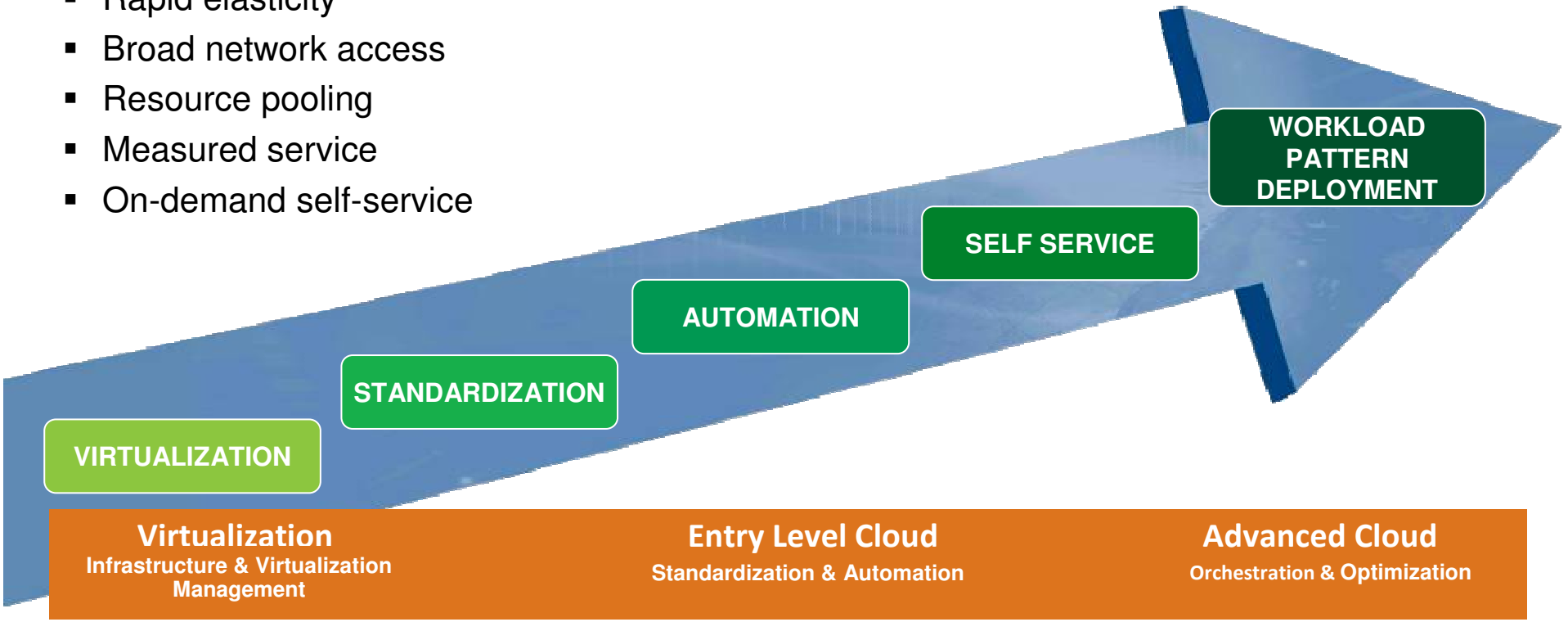
- Built-in hardware redundancy
- Decades of RAS innovation
- Real time capacity on demand to manage growth and handle workload spikes
- Highest security rating for any commercially available server

Cloud Computing - Based on Virtualization and Standardization

We need to understand that Cloud computing is a journey beginning with virtualization and consolidation of environments and ending with workload pattern-based deployment of IT services.

Cloud Computing – Characteristics*:

- Rapid elasticity
- Broad network access
- Resource pooling
- Measured service
- On-demand self-service



* Source: National Institute of Standards and Technology (NIST)

System z Cloud Blueprint

Orchestrate

Advanced Cloud
Orchestration & Optimization

Finally, some customers will want to evolve and optimize their cloud environment to orchestrate application deployment based on reusable workload patterns in order deliver dynamic cloud services.

Automate

Entry Level Cloud
Standardization & Automation

- Customers begin to standardize their environments for faster delivery of services.
- Automation is employed to provision and deprovision virtual guest environments using a shared pool of resources.
- Some customers may choose to allow end-user self service provisioning/deprovisioning.

Integrate

Virtualization
Infrastructure & Virtualization Management

This is where System z drives differentiation!

- Infrastructure Scalability: Consolidate more workloads per core; elastic scaling using Capacity On Demand
- Virtualization Management: More virtual servers in a single footprint
- Security: Highest security rating for tenant isolation
- Reliability & Availability: Unparalleled in the industry

Why do these customers choose Cloud on System z?

- **Scalability** – Cloud on System z customers need to scale quickly and efficiently both up and down with complete confidence and zero loss of availability

VietinBank.
- 800 Bank branches
- 1200 ATM's
- 35% YoY growth

- **Availability** – a guaranteed capability there when you need it to bolster a reputation for the highest service quality


- A SaaS Cloud
- 69,000 users
- 100% YoY growth

- **Multi-Tenancy** – delivering core server incubation services for local businesses

UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO
- An IaaS Cloud
- 60+ tenants

- **Performance** – consolidation of a distributed x86 Linux domain onto a single IBM Cloud on System z with Linux

BALDOR MOTORS • DRIVES • GENERATORS
- 60% compute performance improvement
- 25% employee efficiency

- **Security** – unmatchable world class system security with ensured isolation and protection of each virtual server environment

Handelsbanken
- Improved business continuity posture
- Enhanced security

Credit Union Systems for Brazil (Sicoob) avoids $1.5M in annual costs with IBM mainframe cloud consolidation

SICOOB

Business Challenge:

- Goal of being primary provider of financial services to members
- Needed flexible, secure and scalable IT infrastructure to support reliable 24/7 service and mobile access.

Solution:

- Private System z cloud running 300 production environments
- Replacing distributed, Intel processor-based servers with Linux on z virtual servers

Business Results:

- Avoid $1.5m per year in energy costs, while growing 600%

"We grew by nearly 600 percent; Internet banking grew by 200 percent; for mobile solutions, growth was 600 percent. It would not have been possible to support this growth without IBM System z."

Nationwide Insurance cuts costs with smart workload consolidation of Cloud on System z

Nationwide® On Your Side℠

Business Challenge:

- 3,000 distributed servers inefficient and costly. 80-90% capacity unused, software licenses on every server
- Need to standardize development in Fit-for-Purpose model
  - Take advantage of best platform that met characteristics
- Monitoring/capacity management spans x, z and p based on SLA

Solution description:

Consolidated distributed servers to Linux virtual servers running WAS, DB2, and z/VM on System z creating a multi-platform private cloud optimized for all its different workloads

Customer Value:

- Application Development
- 80 percent reduction in power, cooling and floor space requirements

"The creation of a private cloud built around the z196 servers supports our business transformation goals by enabling the rapid, seamless deployment of new computing resources to meet emerging requirements," Jim Tussing, CTO for Operations, Nationwide

Virtualization and Cloud Portfolio for Linux on System z

Virtualization	Entry Level Cloud	Advanced Cloud
Infrastructure & Virtualization Management	Standardization & Automation	Orchestration & Optimization

zEnterprise: zEC12, zBC12

- Massively scalable
- Characterized by great economics / efficiencies
- Highly secure / available

z/VM 6.3

- Support more virtual servers than any other platform in a single footprint
- Integrated OpenStack support

Linux on System z

- Distributions available from RedHat and SUSE

IBM Wave for z/VM

- A graphical interface tool that simplifies the management and administration of z/VM and Linux environments

Differentiation

Cloud Manager with OpenStack

- A simple, entry level cloud management stack
- Based on OpenStack
- Formerly known as SmartCloud Entry

Standardization

Cloud Management Suite for System z

- Builds on functionality of Cloud Manager with OpenStack and adds runbook automation and middleware pattern support for workload deployment
- Includes SmartCloud Orchestrator
- Also includes Tivoli Storage Manager and OMEGAMON XE on z/VM and Linux

Service Lifecycle Management

z/VM 6.3 – Virtualization with Efficiency at Scale

Improved economies of scale with z/VM Support for 1TB of Real Memory

- **Better performance for large virtual machines**
  - 4x increase in memory scalability while continuing to maintain greater than 90% resource utilization, unmatched in the industry for a multiple diverse workload environment
- **Additional vertical scalability to reduce logical partition (LPAR) sprawl**
  - Considerably more virtual machines may be consolidated into a single LPAR depending on workload characteristics
- **Reduced administrative expense**
  - Savings for management of smaller number of large capacity z/VM host servers

Improved Price Performance with z/VM HiperDispatch

- **Higher and more efficient utilization of CPU resources[1]**
  - Efficient dispatching of CPUs

OpenStack Enablement for Cloud

- **Enables integration for Software Defined Environment**

Simplified migration to z/VM 6.3 with upgrade in place

- **Reduces the impact of an upgrade on active workloads and eliminates the need for separate install volumes**

Support from Tivoli products on day one

- **OMEGAMON XE on z/VM and Linux V4.3**
- **Operations Manager for z/VM V1.5**
- **Backup and Restore Manager for z/VM V1.2**

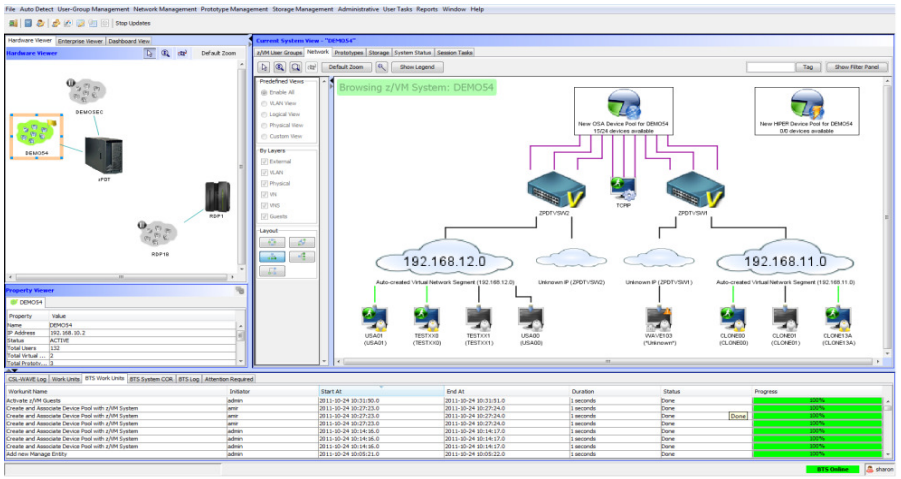
Learn More:
www.vm.ibm.com/zvm630

[1] **The performance boost expected with z/VM HiperDispatch depends on workload characteristics. Memory-intensive workloads running on large numbers of logical processors (16 to 32) are most likely to achieve the highest performance gains.**

IBM Wave for z/VM – High Level Overview

IBM Wave for z/VM (formerly CSL-WAVE) provides the graphical interface that simplifies and helps to automate the management of z/VM and Linux on System z virtual servers.

- **Monitors and manages virtual servers and resources** from a single graphical interface
- **Simplifies and Automates** tasks
- **Provisions virtual resources** (Guests, Network, Storage)
- **Supports advanced z/VM capabilities** such as Single System Image and Live Guest Relocation
- **Allows delegation of administrative capabilities** to the appropriate teams



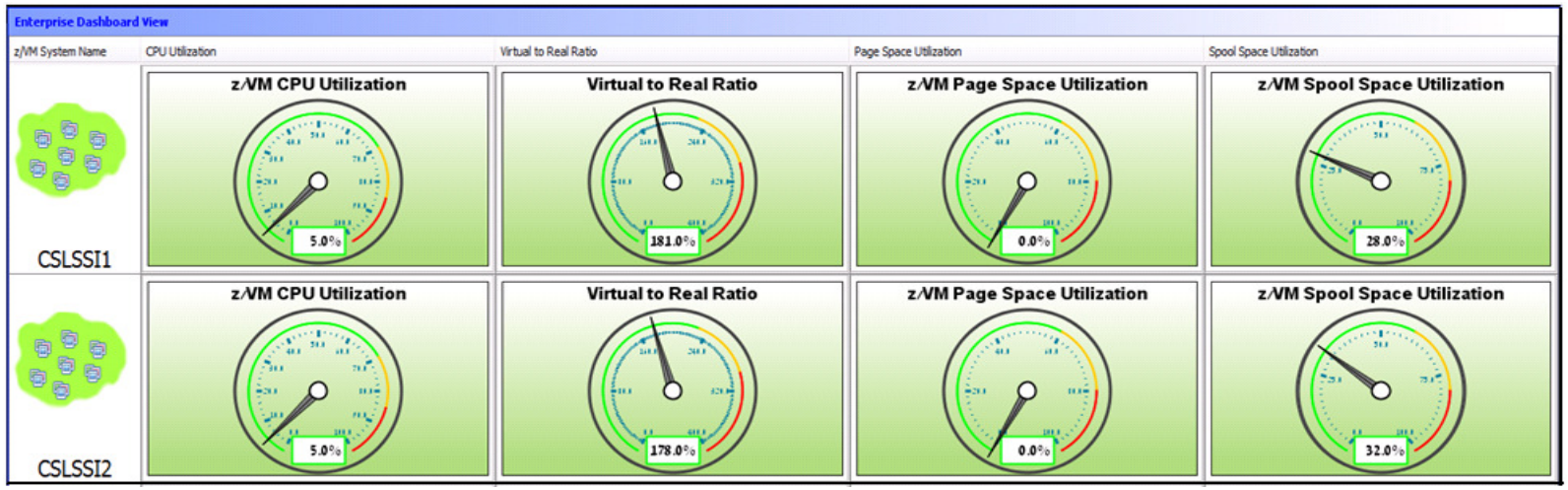
A simple, intuitive graphical tool providing management, provisioning, and automation for a z/VM environment, supporting Linux virtual servers.

IBM Wave for z/VM Foundational Capabilities

- **Inventory Management**
  - Discovers z/VM resources and the relationships among them across multiple LPARs, SSI clusters, and CECs
  - Identifies resource and relationship changes and accommodates them in the resource model and its visual representation
- **Visualization**
  - Rich interface with graphical and tabular displays with layered drill down
- **Monitoring, Systems Management, and Administration**
  - Allows the state of resources to be observed and manipulated in an intuitive manner
- **Automation**
  - Simplifies the process of performing a function across multiple virtual machines and z/VM systems
- **Team Empowerment**
  - Enables different constituencies (operations, systems programming, application development, project management, end users) to exercise their authority to manage appropriate aspects of the z/VM environment

Comparing Performance Monitoring with IBM Wave for z/VM and Omegamon XE on z/VM and Linux

- IBM Wave for z/VM provides real-time monitoring of virtual server resources from a single graphical interface

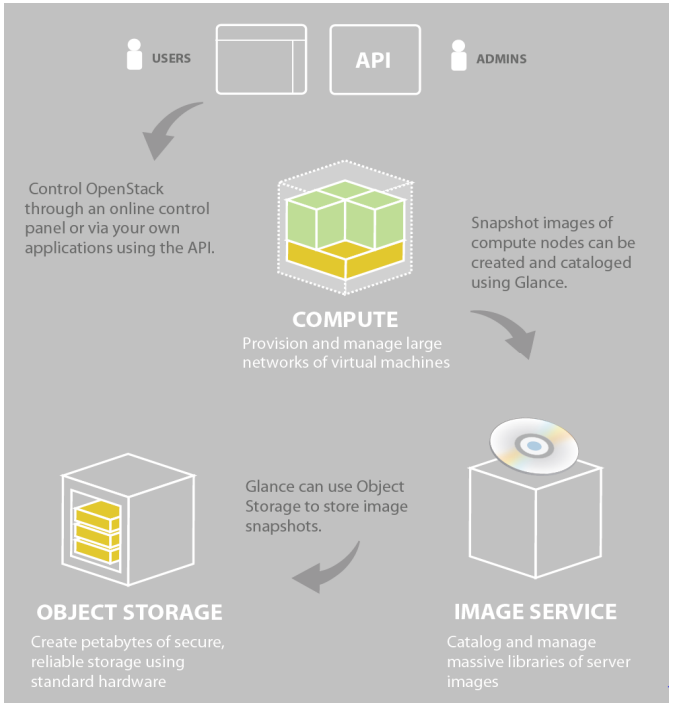


- With Omegamon XE on z/VM and Linux, you have not only real-time monitoring of z/VM, but you also have:
  - Monitoring of individual Linux guest environments
  - Ability to set service level thresholds and generate events when exceeded
  - Historical view of monitoring data
- Both Omegamon XE on z/VM and Linux and IBM Wave for z/VM can coexist in customer environments
- Both gather the data from the Performance Toolkit for z/VM

What is OpenStack?

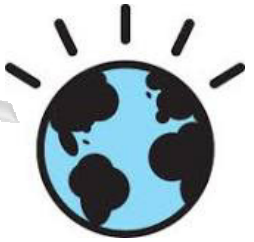
http://openstack.org/

OpenStack is a global collaboration of developers and cloud computing technologists that seek to produce a ***ubiquitous Infrastructure as a Service (IaaS) open source cloud computing platform*** for public and private clouds. OpenStack was founded by Rackspace Hosting and NASA jointly in July 2010. 160 companies and close to 3,000 developers.



- **OpenStack Compute (core)**
  Provision and manage large networks of virtual machines
- **OpenStack Object Store (core)**
  Create petabytes of secure, reliable storage using standard hardware
- **OpenStack Image Service (core)**
  Catalog and manage massive libraries of server images
- **OpenStack Identity (core)**
  Unified authentication across all OpenStack projects and integrates with existing authentication systems.
- **OpenStack Dashboard (core)**
  Enables administrators and users to access & provision cloud-based resources through a self-service portal.

Open source and open ecosystems are important factor in growing markets and fostering technology innovation



September 2012: IBM orchestrates the launch of The OpenStack Foundation boasting $10 million in funding and 5,600 members changing the dynamics of the Cloud ecosystem

openstack™ CLOUD SOFTWARE

150+ interconnected OSS Projects

In the era of a Smarter Planet, IBM will continue to leverage open source ecosystems ….

30-50 OSS Projects

In the era of e-business…

IBM leverages the **nascent open source** software movement…

…and **becomes** the **market leader** in SOA implementations and the world's largest software company

20-30 independent OSS Projects

e-business™

eclipse

Linux

November 2001 – IBM rallies 150 influential vendors and the development community around a new tools environment with a $40 Million software donation disrupting the leadership of the software development ecosystem

September 1999: IBM capitalizes on an untapped market trend and begins participating in the community development of Linux with a $60M annual investment

Apache

June 1998 – IBM enters into an engineering agreement with The Apache Group for development of the open-source Apache HTTP server software eventually becoming the leader of the new Application Server market

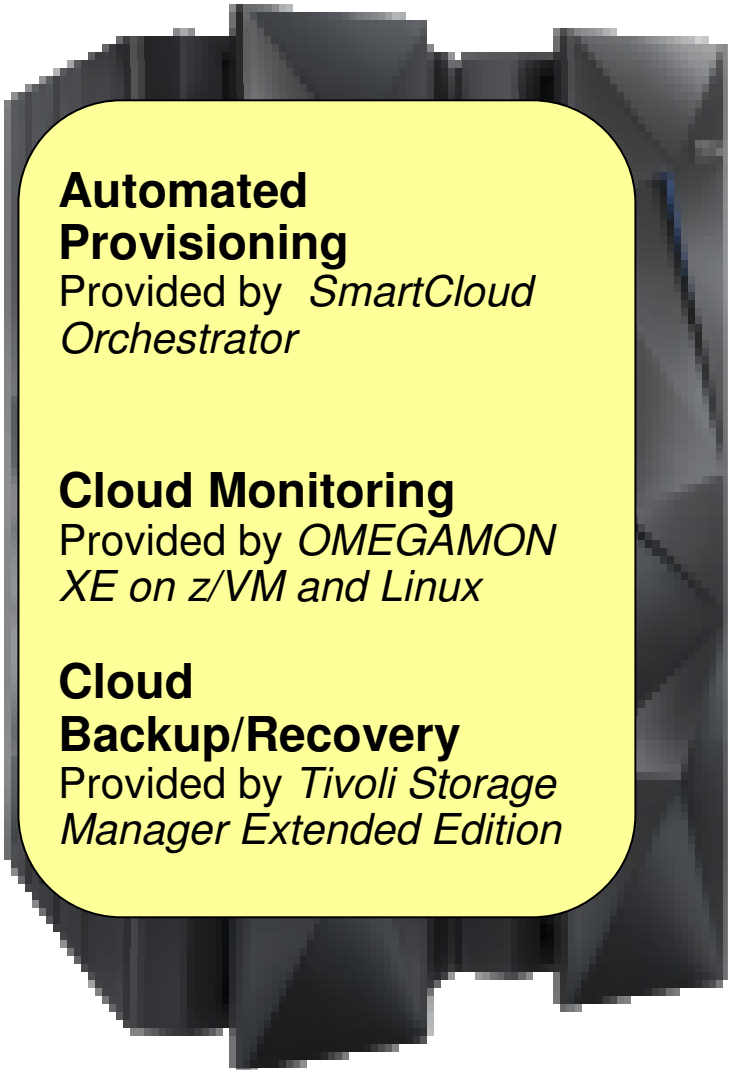
Cloud Management Software for System z

- **Cloud Manager with Openstack** (formerly SmartCloud Entry)
  - A simple, entry level cloud management stack that can be used as a turn-key solution that cost-effectively delivers basic cloud capabilities across all supported IBM platforms.
  - Based on OpenStack – IBM's strategic code base for all cloud management software and services.
  - "managed to" support will come out in June 2014
    - "manage to" requires RHEL to operate, but can deploy workloads on RHEL or SLES
  - "managed from" support will come out shortly
    - "manage from" can work with either RHEL or SLES

Cloud Management Software for System z *(cont.)*

- **SmartCloud Orchestrator**
  - Builds on functionality of Cloud Manager with OpenStack and adds workload pattern support for application deployment.
  - Same pattern technology support as found in IBM Workload Deployer and PureApp Server
  - Also adds runbook automation using WebSphere Business Process Manager (BPM) technology (aka Lombardi)
  - On System z, available as part of the Cloud Management Suite for System z
  - “managed to” support is available (March 2014)
  - “managed to” support for System z requires Cloud Management Suite for System z.
    - Requires RHEL to operate, but can deploy workloads on RHEL or SLES
  - “managed from” support is being worked with development

Cloud Management Suite for System z



Consists of:

- OMEGAMON XE on z/VM and Linux
- Tivoli Storage Manager
- SmartCloud Orchestrator technology

Note: There will be no product called SmartCloud Orchestrator for System z. The only way to get this technology for System z, would be to acquire the Cloud Management Suite for System z offering.

Cloud on System z yields the Lowest Cost

35 very light workloads

10 medium workloads

3 heavy I/O workloads

48 workloads

Public Cloud

48
reserved instances

$3.9M (3yr TCO)

Private Cloud (x86)

55
x86 cores

$1.6M (3yr TCO)

Private Cloud (zBC12)

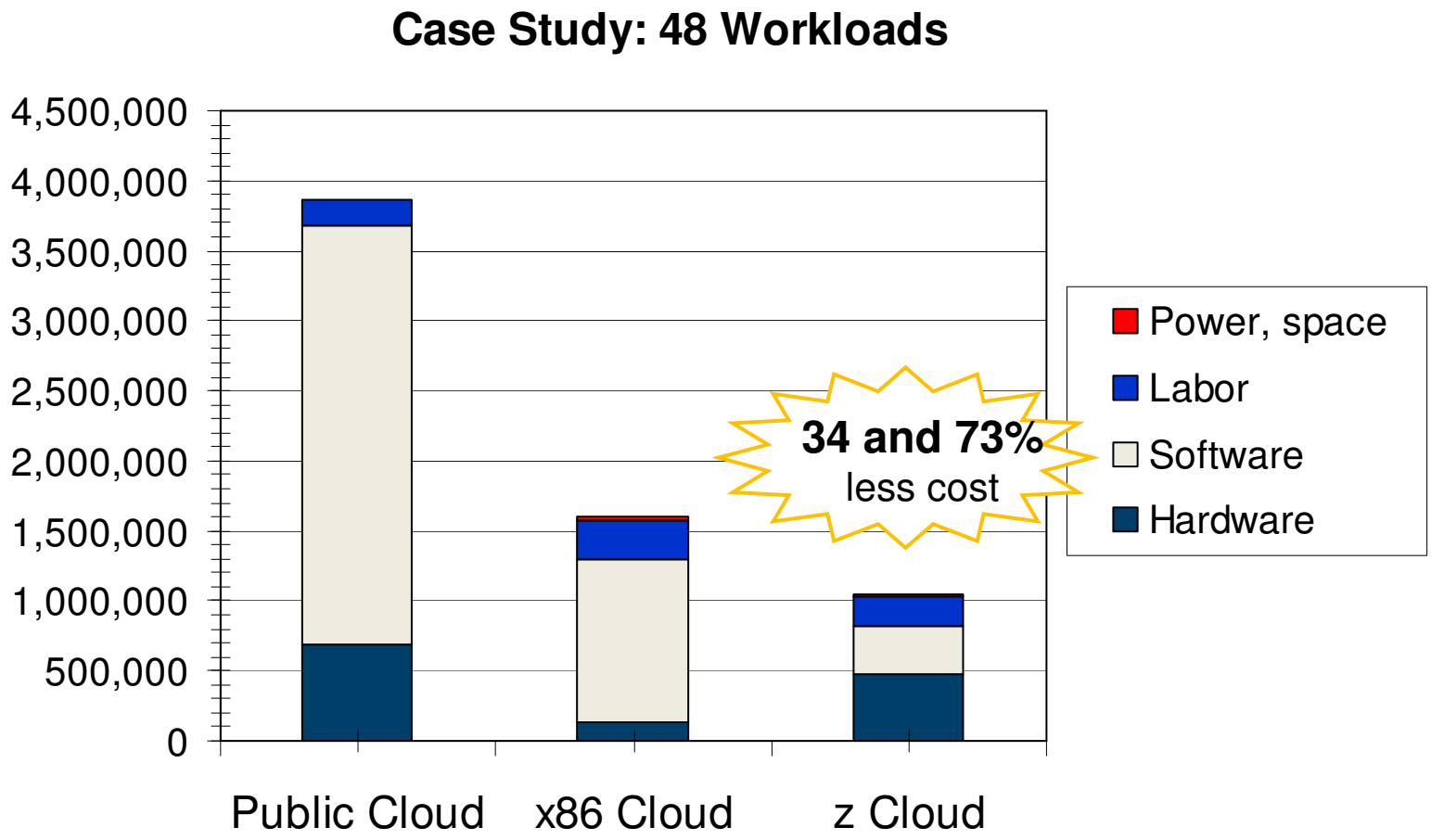
6
IFLs

$1.0M (3yr TCO)

34 and 73% less cost

Server configurations are based on consolidation ratios derived from IBM internal studies. Prices are in US currency and will vary by country. Public cloud case includes costs of hardware (instances, data in/out, storage, support, free tier/reserved tier discounts), software (middleware) and labor. zEnterprise and x86 cases include costs of hardware (system, virtualization, OS), software (cloud mgmt, middleware), power, floor space and labor.

Reduce costs with a System z private cloud



Server configurations are based on equivalence ratios derived from IBM internal studies. Prices are in US currency and will vary by country. Public cloud case includes costs of hardware (instances, data in/out, storage, support, free tier/reserved tier discounts), software (middleware) and labor. zEnterprise and x86 cases include costs of hardware (system, virtualization, OS), software (cloud mgmt, middleware), power, floor space and labor.

A private cloud on System z yields the lowest costs

272 very light workloads

87 medium workloads

39 heavy I/O workloads

398 workloads

Public Cloud

398
reserved instances

$37.0M (3yr TCO)

Private Cloud (x86)

676
x86 cores

$18.3M (3yr TCO)

Private Cloud (zEC12)

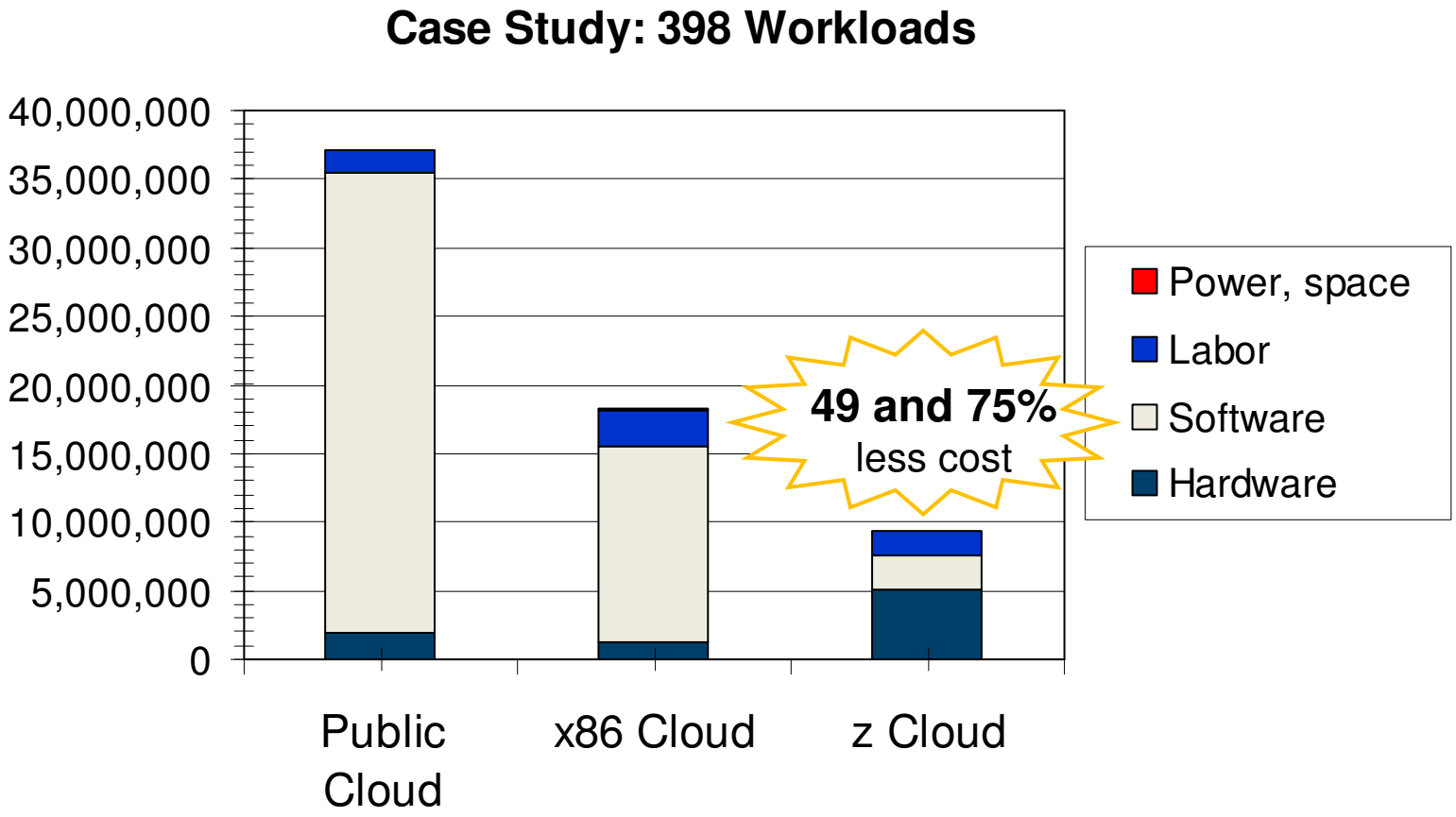
48
IFLs

$9.4M (3yr TCO)

49 and 75%
less cost

Server configurations are based on equivalence ratios derived from IBM internal studies. Prices are in US currency and will vary by country. Public cloud case includes costs of hardware (instances, data in/out, storage, support, free tier/reserved tier discounts), software (middleware) and labor. zEnterprise and x86 cases include costs of hardware (system, virtualization, OS), software (cloud mgmt, middleware), power, floor space and labor.

Reduce costs with a System z private cloud



Server configurations are based on equivalence ratios derived from IBM internal studies. Prices are in US currency and will vary by country. Public cloud case includes costs of hardware (instances, data in/out, storage, support, free tier/reserved tier discounts), software (middleware) and labor. zEnterprise and x86 cases include costs of hardware (system, virtualization, OS), software (cloud mgmt, middleware), power, floor space and labor.

System z Cloud Ecosystem Overview for *Linux on System z*

Integrate → **Automate** → **Orchestrate**

IBM Products & Offerings

- **zEnterprise: zEC12, zBC12**
- **Linux on System z**
- **z/VM 6.3**

xCAT
- Extreme Cloud Administration Tool
- Now shipped in z/VM 6.3

- **Cloud Ready for Linux on System z**
- **Cloud Manager with OpenStack**
- **Cloud Management Suite for System z (powered by Cloud Orchestrator)**

IBM Wave
- Hypervisor Manager
- Graphical management of z/VM environment
- To be sold with ELS, ECS

ISV Solutions

zPRO
- Provided by **Velocity Software**
- Add-on feature to Velocity's zVPS product that provides performance management
- Provides golden image creation, cloning, and operational controls

CA AppLogic
- Provided by **CA Technologies**
- Provisioning and full lifecycle management for both distributed and z/VM environments

MOAB
- Provided by **Adaptive Computing**
- Provides a policy based cloud management based on xCAT

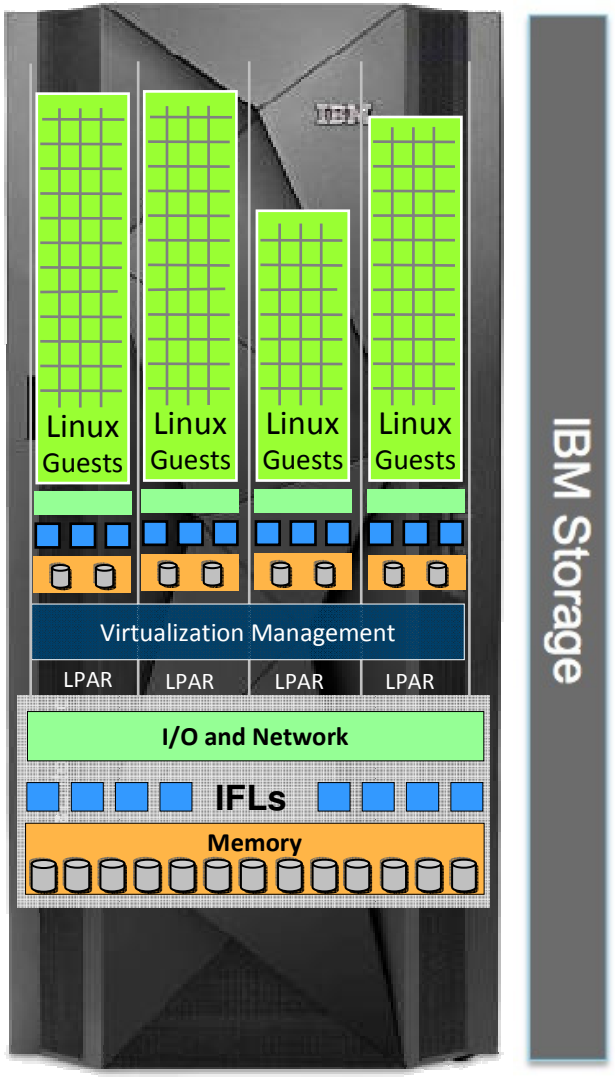
Open Source Options

OpenStack
- Being enabled for z/VM first and eventually zManager
- Being used as a code base for Cloud Manager and Cloud Orchestrator

Introduction to IBM Enterprise Cloud System

Converged Infrastructure-as-a-Service solution, providing a highly available, secure, cloud platform based on System z technology

- **Pre-configured and integrated system**
  - Includes Processor, Disk, Hypervisor, Cloud Management Software and Services
  - Pre-installed cloud management software that leverages open source such OpenStack and Linux to deliver orchestration, provisioning and monitoring
  - Integration performed at IBM's Customized Solution Center and onsite by STG Lab-Based Services
- **Flexible configurations**
  - No fixed sizes - flexibility on hardware configurations allow customers to choose the right amount of resources for their workload
  - Sample configurations will be provided to Sales Team as guidance and comparison



Target Market for Enterprise Cloud System

- **First in Enterprise**
  - Customers new to the System z platform looking to leverage cloud as a deployment model
  - Customers looking to reduce software license costs through consolidation to the mainframe
- **Managed Servicer Providers**
  - Businesses that have or are transforming to a Cloud Service Provider business model
  - Service providers looking to offer differentiated services

➔ **Both market segments**

- Likely to have minimal mainframe skills
- Cost is the key driver behind platform deployment decisions
- Require an easy to deploy system
- Require support for business critical workloads needing security, multi-tenancy and availability

Composition of Enterprise Cloud System

Server

or

zEnterprise BC12 zEnterprise EC12

Storage

Storwize V7000

or

DS8870

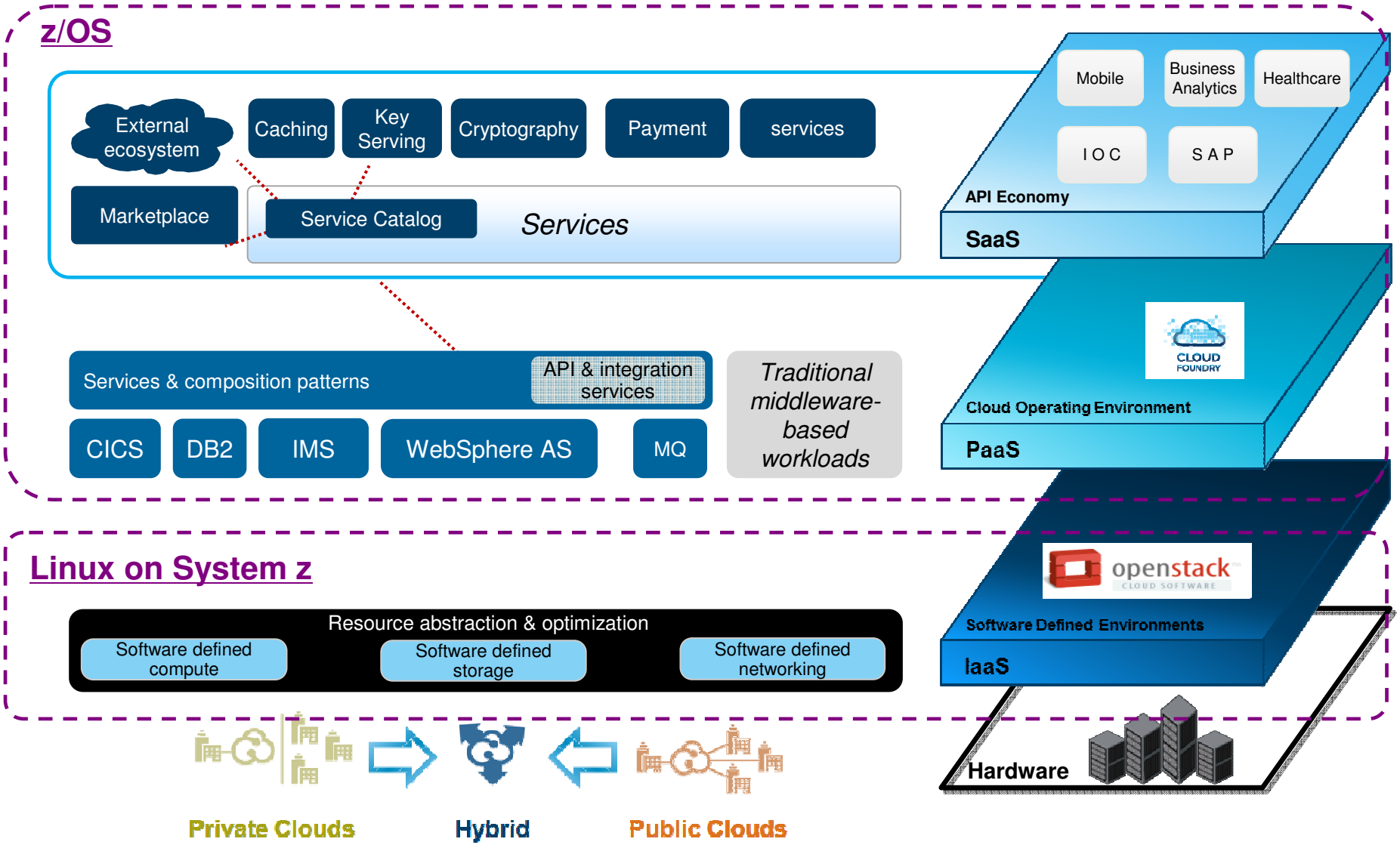
Software

- z/VM with following priced features:
  - Directory Maintenance
  - Resource Access Control Facility
  - Performance Toolkit
  - Single System Image
- IBM Wave for z/VM
- Cloud Management Suite for System z
- Operations Manager for z/VM
- Backup and Restore Manager for z/VM
- RHEL and/or SLES Linux for System z

Services

- Integration Services
  - Performed by WW Customized Solutions Center in Poughkeepsie, NY
  - Will integrate server and storage devices and pre-install software prior to shipment to the customer
- On-Site Personalization Services
  - Performed by STG Lab Based Services to complete SW installation and personalize Enterprise Cloud System for the customer

System z Cloud Architecture



Cloud Computing on z/OS

With z/OS, we need to think about cloud just a bit differently…..

- Today in cloud environments on distributed servers, or even with Linux on System z, customers would provision a virtual machine with an instance of an operating system to run a single workload.
  - To deploy another workload would mean another virtual machine with another instance of the operating system.
- However, in the context of z/OS, this methodology goes against everything we have come to know and expect about z/OS.
  - On z/OS, you have the ability to run multiple disparate workloads with different service levels for those hosted workloads with isolation or multitenancy.
- Hence our **approach for cloud on z/OS** is not focusing on the provisioning of operating system instances, but rather **the ability to provision multiple workloads in a single z/OS instance.**

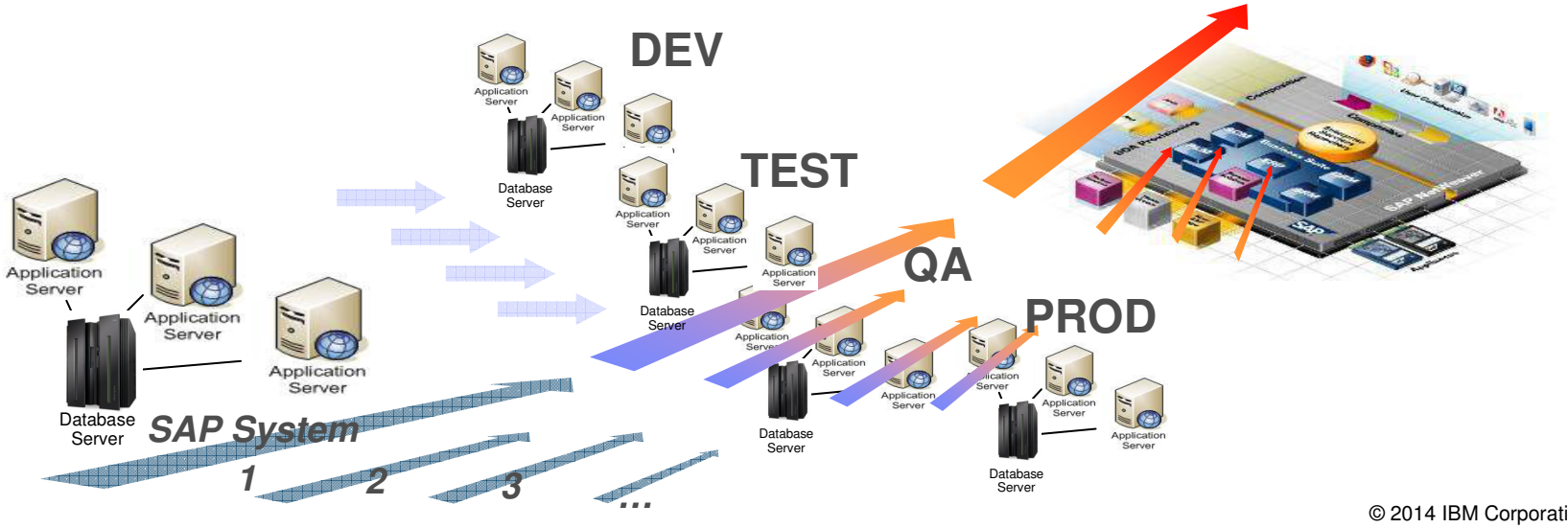
IBM Entry Cloud Configuration for SAP Solutions on zEnterprise

Customer Challenges:

- Explosive growth in the number of SAP systems
- Dependence on labor intensive processes
- SAP operational budgets are draining valuable resources
- Need for improved productivity of teams to implement and manage

Solution:

A cloud enablement offering, that combines technology and services to automate, standardize, and speed up day-to-day operations of SAP on System z environment resulting in reduced operational costs and faster time to value.



Entry Cloud Solution for SAP

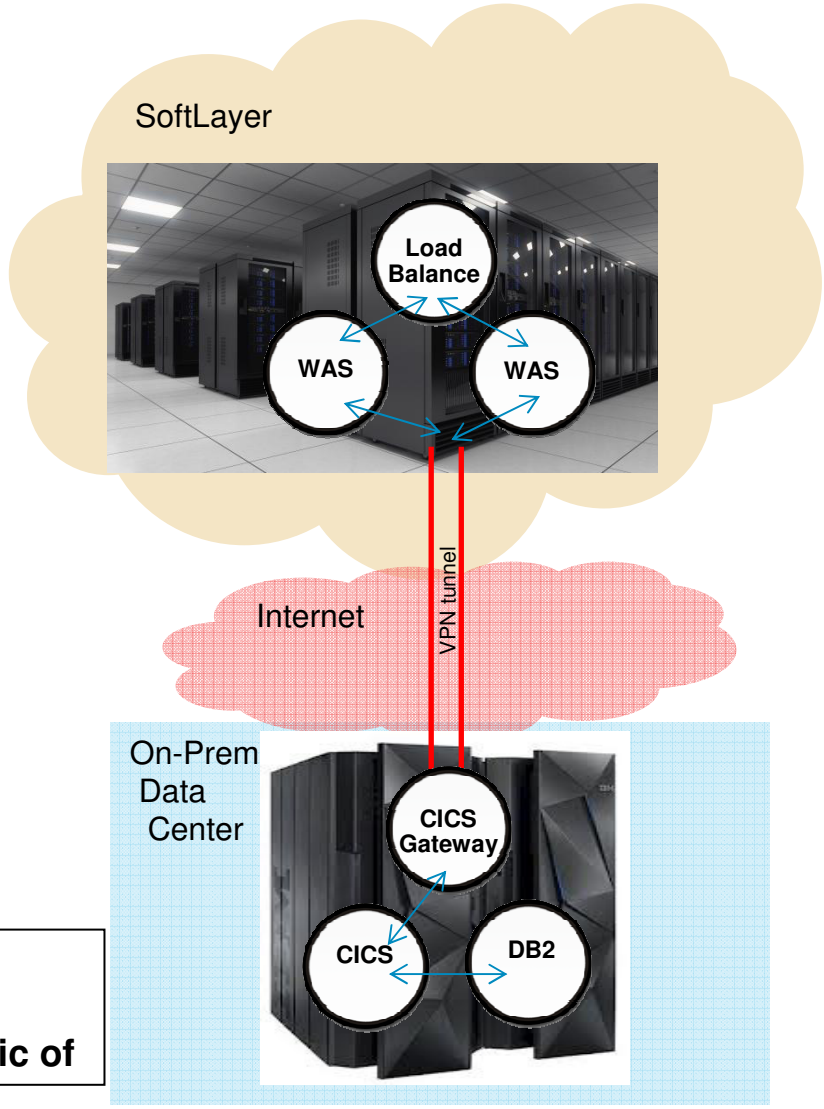
- Automated lifecycle management operations
  - Provisioning
    - Installation of DB2 Subsytems
    - Installation of DB2 Data Sharing Groups
  - Backup / Restore / Clone
    - Offline Backup / Restore (logical dump)
    - Clone based on Offline Backup
    - Backup System (System Level Backup)
    - Clone based on SLB
  - Patch Management
  - Release Migration
  - Extensibility (custom parameters, custom workflows)
- Expose services to external management systems via REST Interface

Database Provisioning System - Observed Efficiences

Process		Before (w/o DPS)	After (w/ DPS)
DB Admin	Install DB2	1 day	12 min
	Maintain DB2 libraries	½ day	8 min
	Clone DB2	2-3 days	20 – 180 min
Unix Admin	Install Operating System	1 day	30 – 60 min
SAP Basis	Prepare Upgrade / Provide SAP System	2-3 days	~ 40 – 200 min

Hybrid Cloud Enterprise Architecture: Overview (System z and SoftLayer)

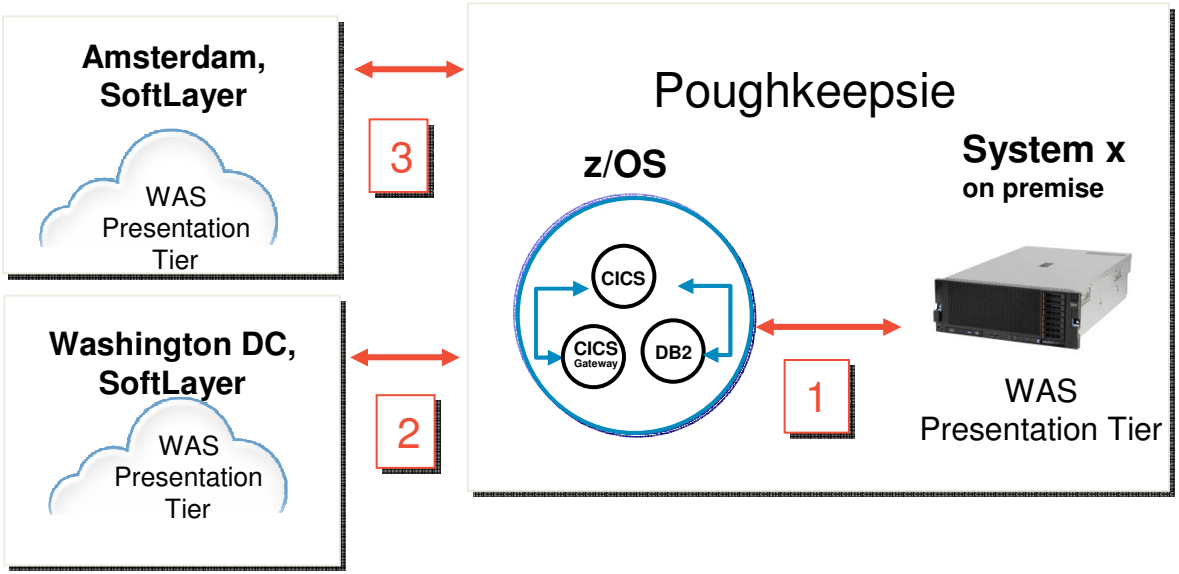
- CICS OLTP System on-premise Data Center
  - Provides best-of-breed OLTP system
  - Exploiting security and scalability of GDPS
- Application server on SoftLayer Cloud Server
  - Hosts application / presentation tier on dedicated or virtual server
  - Elastically scales compute capacity
  - Reduces costs by paying for capacity
- Secure VPN Tunnel
  - Provides secure means to cross public network
  - Presents private network of SoftLayer as extension of on-premise private network



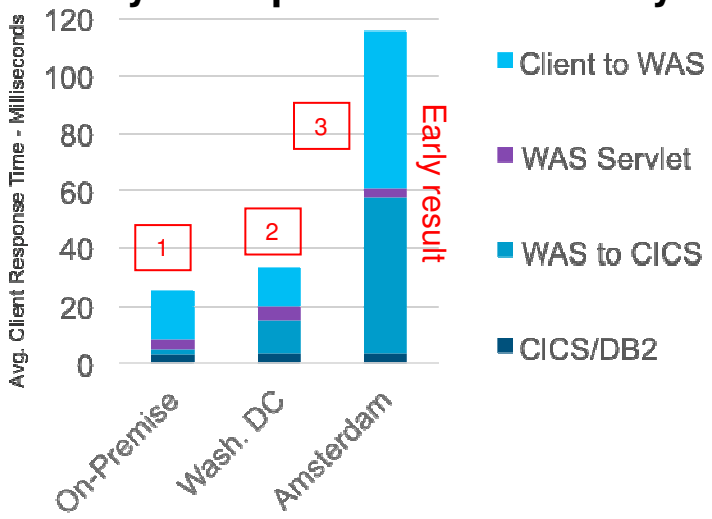
Hybrid Architecture provides best of both worlds

Secure Transactions combined with the dynamic of Cloud

On premise and off premise: System z and SoftLayer
System z delivers the performance you need



Latency – On-premise vs. SoftLayer



Results

No surprises or issues in implementing the Hybrid architecture

No major performance impacts from added security

Relatively small performance impact accessing z/OS from SoftLayer

---

21/105 ms increase in latency for each CICS call

Washington DC, a 8 ms increase in average client response

Amsterdam a 91 ms increase in average client response

No significant change in transaction rate or z/OS load

Consolidate and Deploy Software to the "Best Fit" Technology

- Extreme consolidation of servers and networking
- Run up to hundreds of distributed server workloads on a single server
- Fewer components and reduced complexity
- Excellent price performance from a software licensing perspective
- Industry-best virtual I/O bandwidth and reliability
- Superior levels of virtual server provisioning, monitoring and workload management
- System z qualities of dynamic resource management and capacity-on-demand

Why You Should Implement a Private Cloud on IBM zEnterprise

- The IBM SmartCloud open cross-platform architecture includes zEnterprise within a fit-for-purpose framework
- zEnterprise optimizes critical business workloads for private clouds
- IBM zEnterprise is a platform for open heterogeneous enterprise private clouds
- zEnterprise provides the lowest TCO coupled with industry leading Quality of Service and security

Thank You!